THURSDAY, NOVEMBER 14, 1912.

ELECTRONS AND THE ELECTRO-MAGNETIC FIELD.

Electromagnetic Radiation and the Mechanical Reactions arising from it. Being an Adams Prize Essay in the University of Cambridge. By Dr. G. A. Schott. Pp. xxii + 330. (Cambridge: University Press, 1912.) Price 18s. net.

PROF. SCHOTT'S original essay is, in this book, supplemented by a series of valuable appendices, which amply justify the delay in its publication. The work is deductive in plan; its foundations are the electromagnetic equations of Maxwell and Hertz, together with the Larmor-Lorentz expression for the mechanical force on a moving charge. The "retarded potentials" of the electromagnetic field are transformed so as to yield Schott's solutions, in the form of "modified Fourier integrals," and most of the calculations are performed from these as starting point. They lead simply, and with considerable mathematical rigour, to many results obtained by other writers; in particular, the "point laws" of Liénard and Wiechert are deduced, and are used to illustrate the general features of the electromagnetic field in a number of special cases. The exact calculations, however, are more readily executed with Schott's expressions, and various simple cases of motion of electrons are thus dealt with, as, *e.g.*, uniform or uniformly accelerated rectilinear motion. Periodic motions, such as uniform circular motion of a single electron, or of a ring of electrons, are also discussed. More complex cases, like pseudo-periodic or aperiodic motions, cannot be solved completely, but the distant field is approximated to. Specially interesting are the problems relating to the pulse theory of the X-rays, and the precessional motion of a ring of electrons, as applied to Ritz's theory of the Zeeman effect.

The velocities of the electrons are not restricted to be less than the velocity of light, chiefly because the mathematical expressions require no such condition (though the work is far simpler in the restricted case). It is pointed out that no experimental evidence, either way, has been brought to settle the question of the possibility of velocities exceeding that of light; if the Lorentz mass-formula were universally true, indeed, the question would be decided in the negative, but this formula has been verified (by Bucherer) only for velocities considerably less than that of light. Moreover, the theory of relativity, which is based on this formula and has proved useful in explaining aberration phenomena and the behaviour of moving optical systems, neglects the loss of energy

by radiation from accelerated charges; this, however, becomes very important for velocities approaching that of light.

In the appendices several theorems are proved which lead up to an interesting discussion of the possible mechanical explanations of the electron. It is shown that the Lorentz deformable electron is more easily explained mechanically than the electrons of Abraham and others, as it only requires an invariable hydrostatic pressure of the æther over its surface to enable it to subsist. This pressure is estimated (p. 269) as 10^{25} atmospheres. Moreover, the mass-formula for such an electron is practically the only one which can be applied in the mathematical theory of the mechanical forces and the radiation.

For the mathematician the book abounds in problems and suggestions of interest and importance; especially does it clearly display the need for the cooperation of the pure analyst in the study of the summation and convergence of the difficult series and integrals which occur in its investigations. The physicist will, perhaps, find it rather tedious to unearth the physical conclusions (which are pointed out from time to time in the course of the work) from the mass of complicated mathematics in which these remarks are involved. The great value of the book would have been increased if the physical bearing of the results had been summarised in an extra chapter; this is done to a slight extent in the preface. A greater number of numerical calculations would also have been advantageous in giving a clearer grasp of the results, but the great labour required for such an undertaking sufficiently explains the omission.

THE LAND AND ITS LORE.

(1) *Common Land and Inclosure.* By Prof. E. C. K. Gonner. Pp. xxx + 461 + 5 maps. (London: Macmillan and Co., Ltd., 1912.) Price 12s. net.

(2) *Byways in British Archaeology.* By Walter Johnson. Pp. xii + 529. (Cambridge: University Press, 1912.) Price 10s. 6d. net.

(1) **S**CIENTIFIC studies of the history of landholding have a peculiar importance at the present moment, when legislative innovations in ownership are so widely mooted on *a priori* grounds. By supplying valid inductions from the past, science here, as in other spheres, provides the statesman with a solid foundation for political principles, and a sure test for fallacious schemes.

The entire history of English agriculture, so far as it is connected with national progress and advance in civilisation, is bound up with "common" and inclosure, and the passage from the

former to the latter. The land question, it is not too much to say, cannot be begun to be understood until this relation has been worked out.

"Common" in early times was "in entire contrast to the ideas associated with it in the present day. . . . Its existence now is taken as denoting the claims, somewhat vague and precarious, of the public as against those holding the land and engaged in its cultivation. But this finds no sanction in a time when . . . common was a result of a claim to land, and formed a necessary condition of its proper management. . . . The early rights of common were anything . . . rather than a general claim on the part of the public. . . . The common right was an essential part of agriculture, and it was only as, owing to changes in circumstances, this became less apparent, that casual profits and gains and the so-called rights of the poor, these latter being in many instances a trespass and not a right, came to be important."

Thus Prof. Gonner defines his subject. The history of the method of common and of the gradual progress of inclosure occupies two-thirds of the volume. The rest is devoted to the effects of the evolutionary change. Inclosure is part of "a wider economic movement." Its "beneficial effect on farming is undoubted . . . particularly in the increased utilisation of what is, after all, the distinctive agricultural wealth of England, rich grazing and dairy lands." Of particular importance is its connection with "the change whereby agriculture, from being a means of subsistence to particular families, had become a source of wealth to the nation." It is particularly interesting to the sociologist to note that rural population "did not vary with inclosure, and that this movement was not, at any rate, the main cause of the increase in poor relief expenditure."

Prof. Gonner has written an invaluable study, which is final, and should become a classic. No sociologist and no statesman can afford to ignore it.

(2) The author of "Folk Memory" devotes 400 pages to answering the question: In what ways may the church-fabric be regarded as the social centre of early English life? There is abundance of original observation, and in controverted matters, such as round towers, the author's judgment is eminently reasonable. For he treats these radiating paths of folklore—they are this rather than byways—from a wide sociological outlook. In "The Folklore of the Cardinal Points," and "The Labour'd Ox," he treats new ground. "The Cult of the Horse" is an interesting compilation of palæontological data and early English horse-lore. The "White Horse," and what amounts still to a tabu against eating horseflesh, receive

illumination. Mr. Johnson believes that folk-memory is on the wane, since "the printed book and the daily newspaper . . . remove the need for its lawful exercise." It would be more scientific, perhaps, to regard the ultra-popular reactions to these modern influences as being themselves a new stage of folk-thinking and folk-memory.

A. E. CRAWLEY.

ENGINEERING HANDBOOKS.

- (1) *Reference Book for Statical Calculations (Rapid Statics), Force-diagrams for Frameworks, Tables, Instructions for Statical Calculations, &c., for all Classes of Building and Engineering.* By Francis Ruff. Pp. 136; illustrated. Vol. i. (London: Constable and Co., Ltd., 1912.) Price 4s. net.
- (2) *Les Nomogrammes de l'Ingénieur.* By Ricardo Seco de la Garza. Avec une Préface de Maurice d'Ocagne. Pp. xii + 195 + 85 plates. (Paris: Gauthier-Villars, 1912.) Price 12 francs.
- (3) *Laboratory Instruction Sheets in Elementary Applied Mechanics.* By Prof. A. Morley and W. Inchley. Pp. v + 50. (London: Longmans, Green and Co., 1912.) Price 1s. 3d. net.
- (4) *A Handbook on the Gas Engine.* Comprising a Practical Treatise on Internal Combustion Engines. By Herman Halder. Translated from the German and Edited by W. M. Huskisson. Pp. xii + 317. (London: Crosby Lockwood and Son, 1911.) Price 18s. net.
- (5) *Concrete Costs.* Tables and Recommendations for Estimating the Time and Cost of Labour Operations in Concrete Constructions and for Introducing Economical Methods of Management. By Dr. Frederick W. Taylor and Stanford E. Thompson. First edition. Pp. xxii + 709. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1912.) Price 21s. net.

(1) **T**HE usual graphical methods for determining the stresses in framed structures form the subject of this little book. With the exceptions of the wind pressure on roof trusses, the load on a framework column, and pressure upon retaining walls, the structures are subjected to symmetrical loads concentrated at the joints. Each form of roof, bridge truss, girder, or cantilever occupies a separate page, together with its reciprocal figure, the construction of the force polygons being described on the opposite sheet. There are some thirty examples of the usual forms of truss, covering the ordinary cases that occur in engineering practice. The method adopted of forming the reciprocal figures loses much by the notation employed, and is far less satisfactory